

# Exploration Medical System Technical Development

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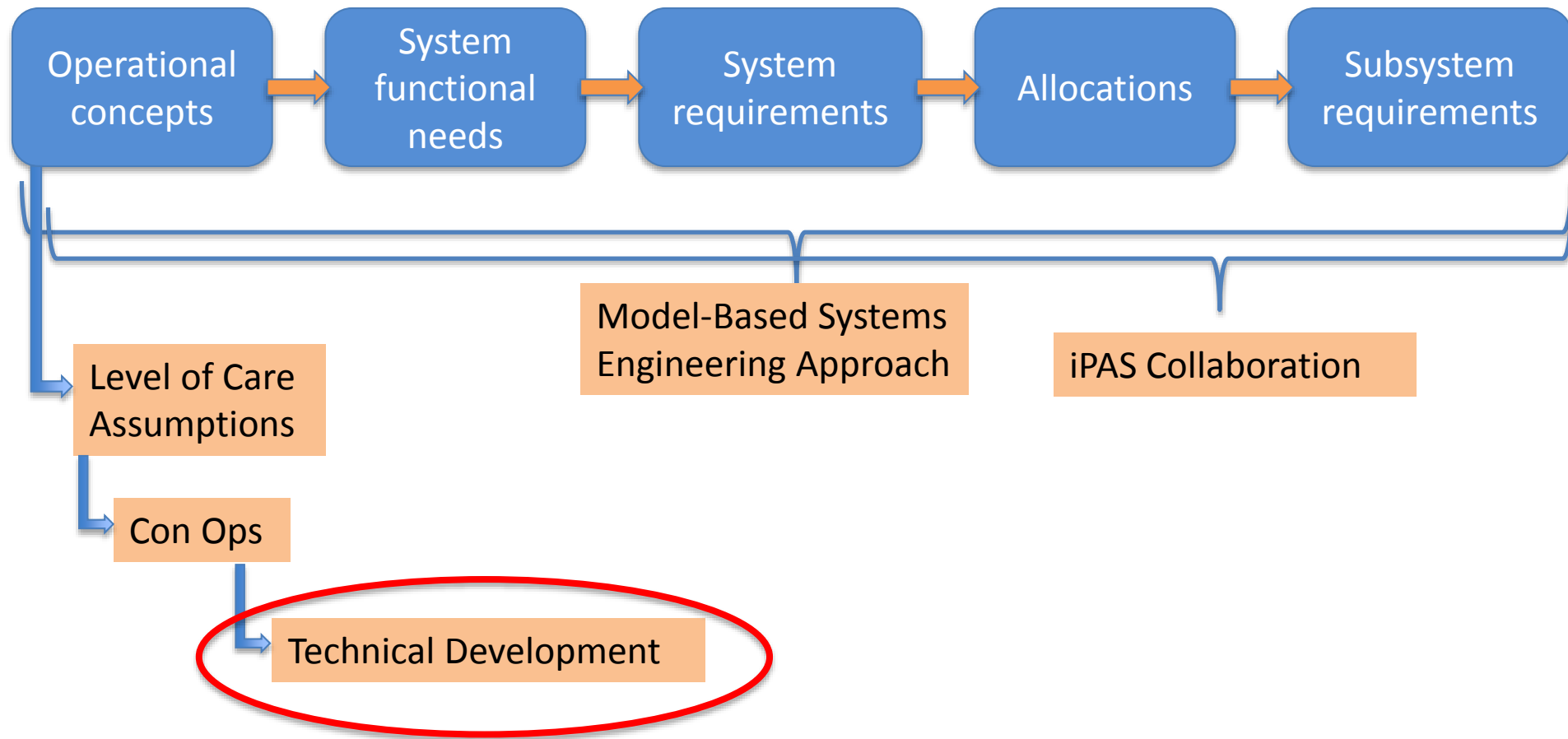
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HRP Investigators' Workshop

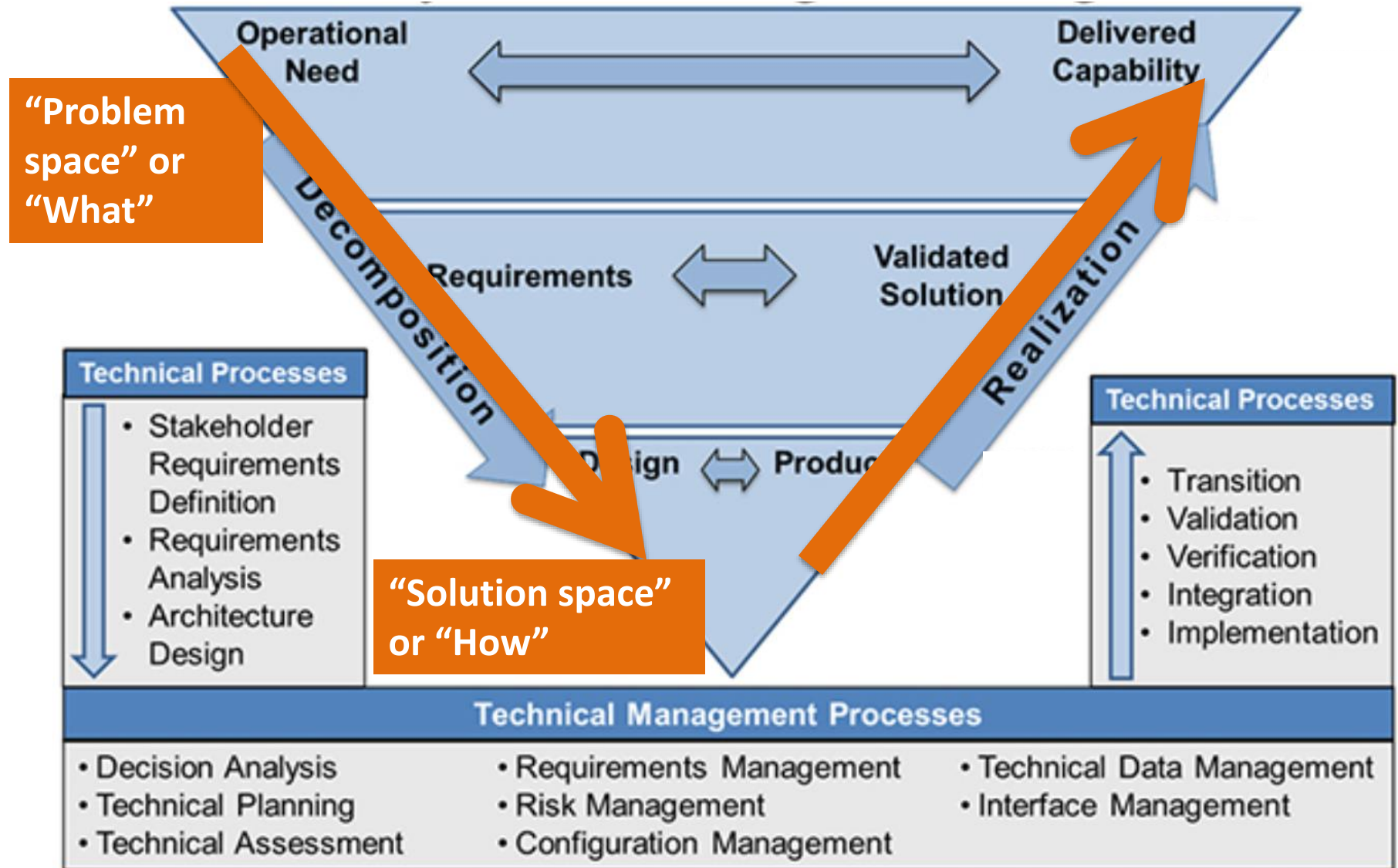
1/23/2017

# Systems Engineering Session Talks

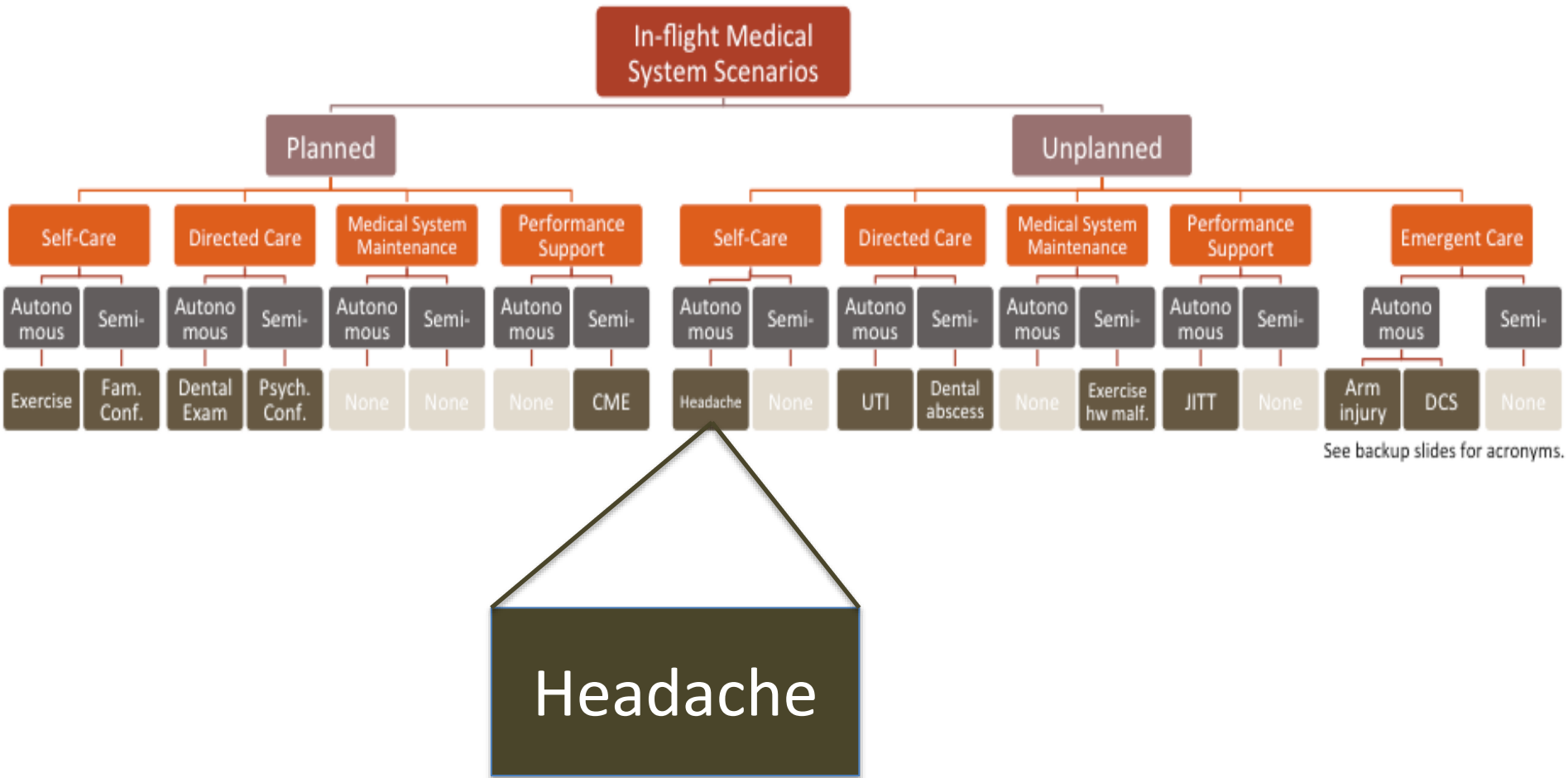


*The needs identified by this work will drive future ExMC research*

# Review -Systems Engineering “V”



# Review-Con Ops Scenario Tree



# Con Ops Headache Scenario Example

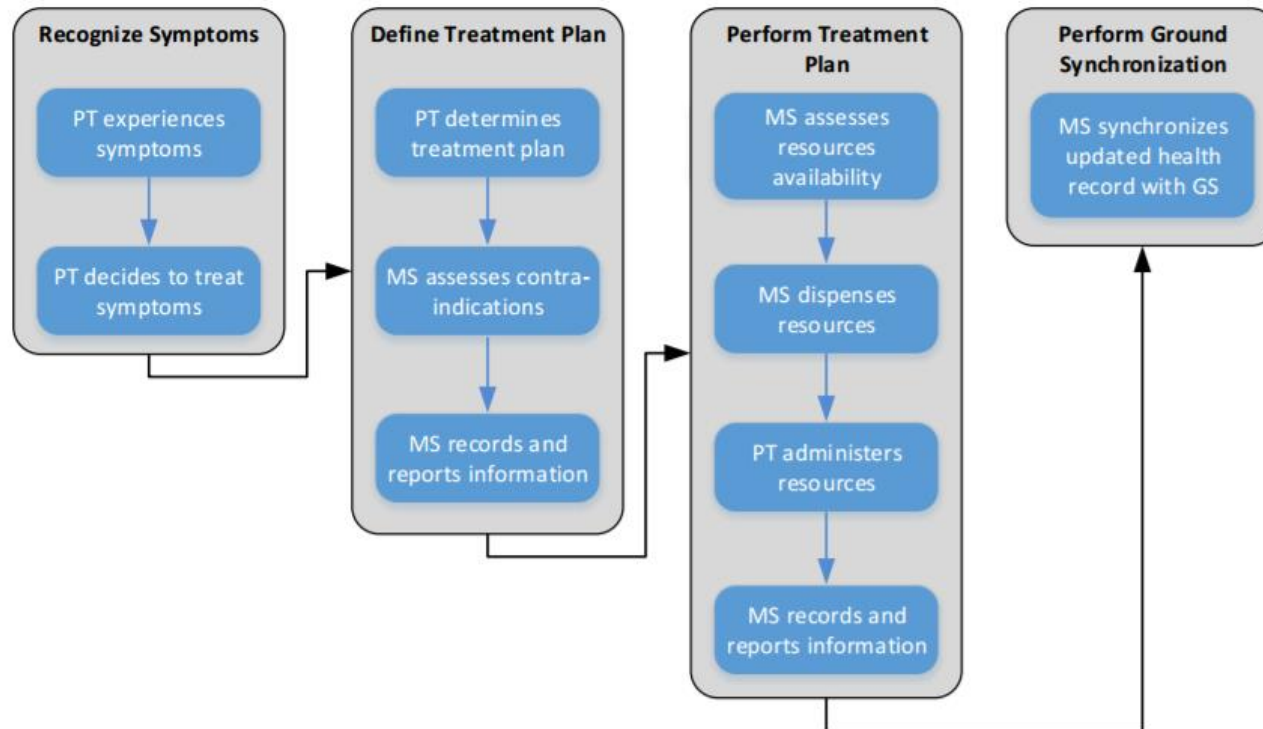
**Scenario:** 03. Transit – IVA – Unplanned – Self-Care – Autonomous from Ground

**Context:** Headache

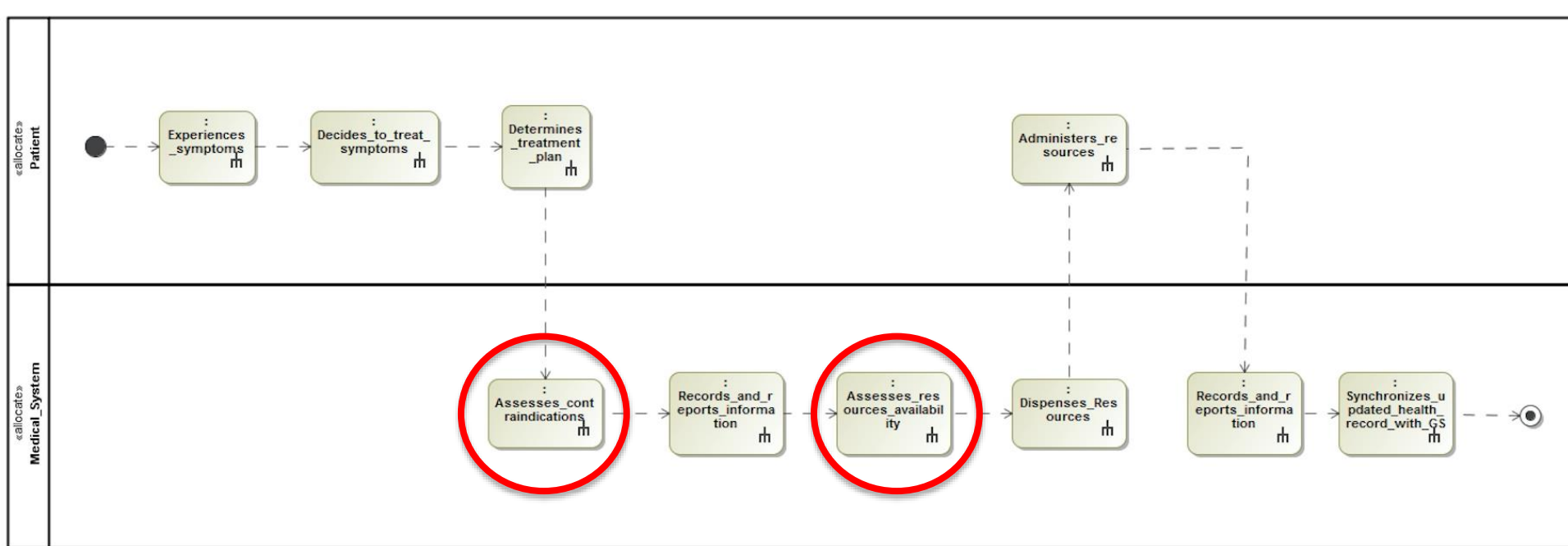
**Assumption:**

1) The “resource” in this scenario is a medication

**Key:** MS = Medical System      PT = Patient  
GS = Ground System



# Identify Needed Functions



Assess  
contraindications

Assess resource  
availability

# Identify Interactions

sd [Interaction] 03\_Transit IVA Unplanned Self Care Autonomous from Ground [ 03\_Transit IVA Unplanned Self Care Autonomous from Ground ]

## Assumptions

1) The resource in this scenario is a medication

«block»  
pt : Patient

«comment»  
Pt experiences symptoms and decides to self treat

«block»  
ms : Medical\_System

«block»  
vh : Flight\_Vehicle\_System

«block»  
gs : Ground\_System

1: msPtInputTreatmentPlan

2: msAssessContraindications

3: msRecordReportInfo

4: msAssessResourceAvail

5: ptMsDispenseResource

6: msRecordReportInfo

7: vhMsTxHealthRec

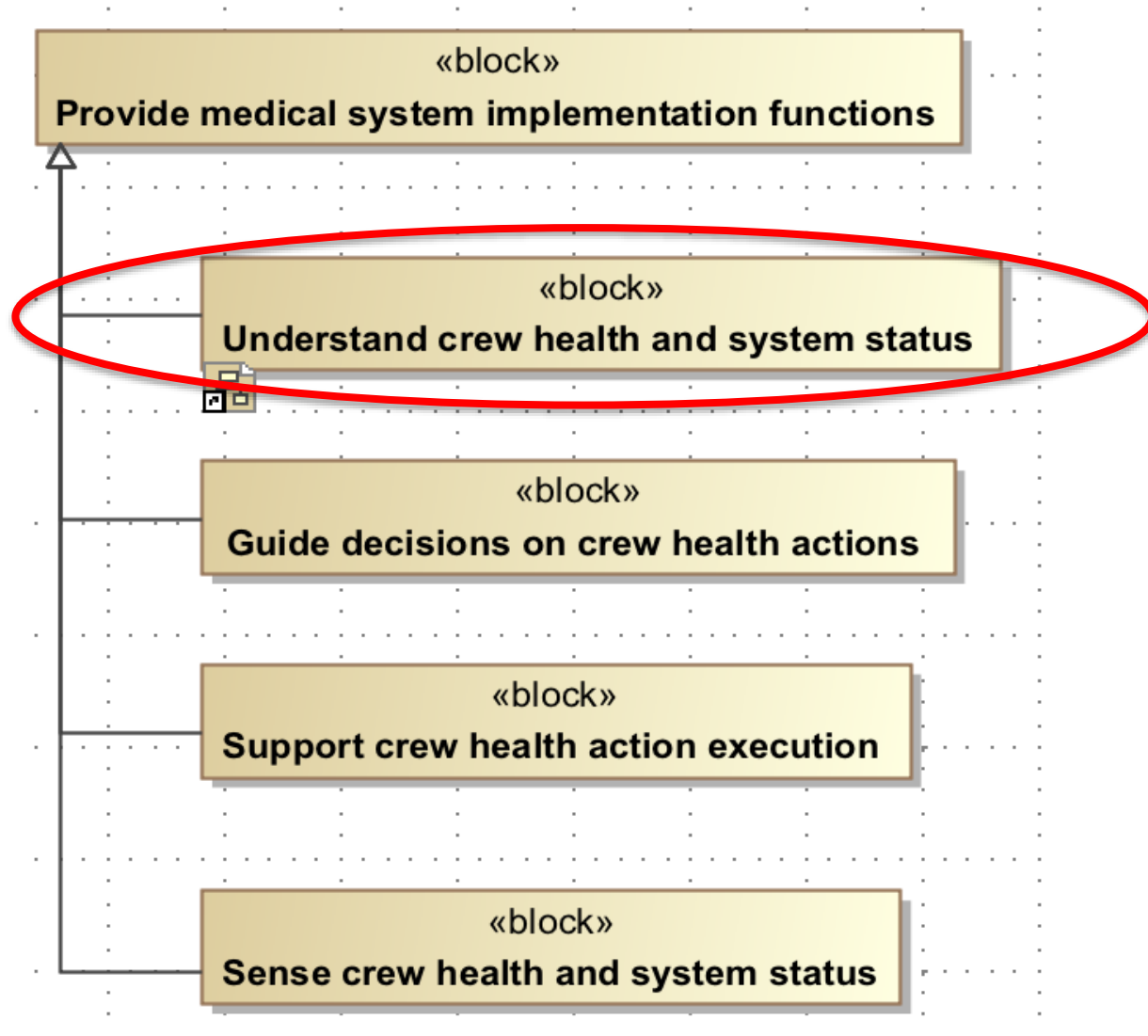
8: gsVhTxHealthRec

Accept treatment plan  
input from patient

Dispense medical  
resource to patient

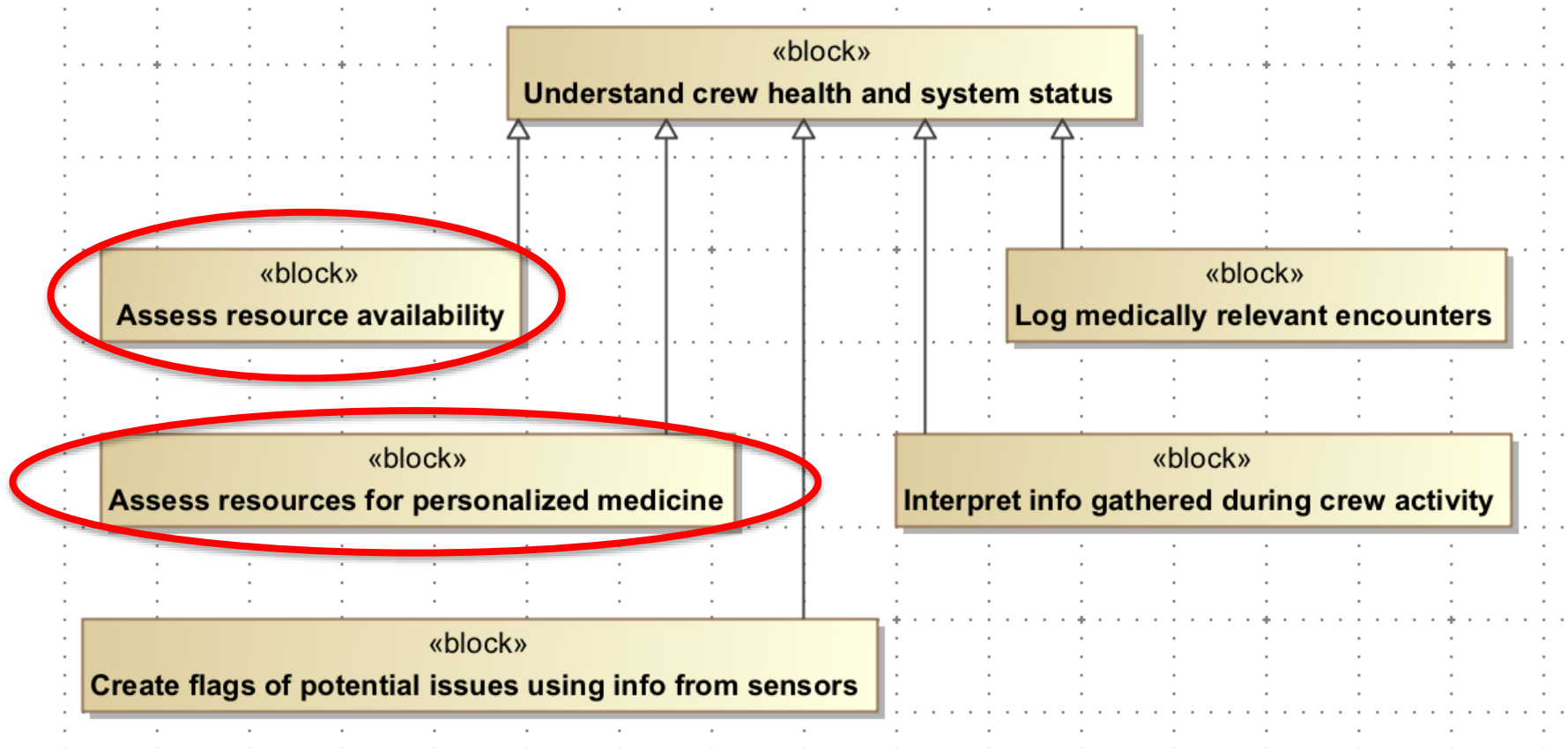
# Build Functional Decomposition

- Begin defining problem space



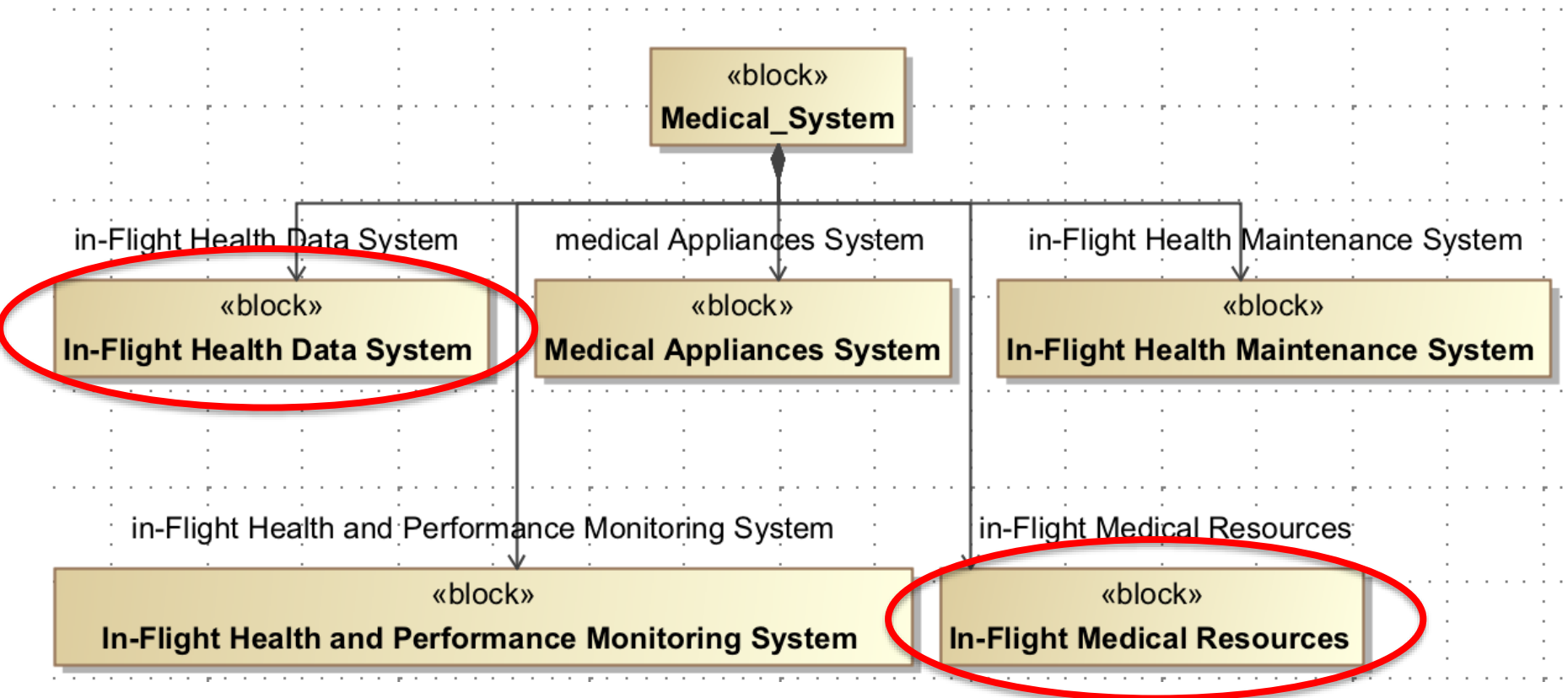


# Build Functional Decomposition Cont.



# Draft System Architecture Decomposition

- Now begin bridging to “Solution Space”



# Example Traceability to Requirements

Operational concepts

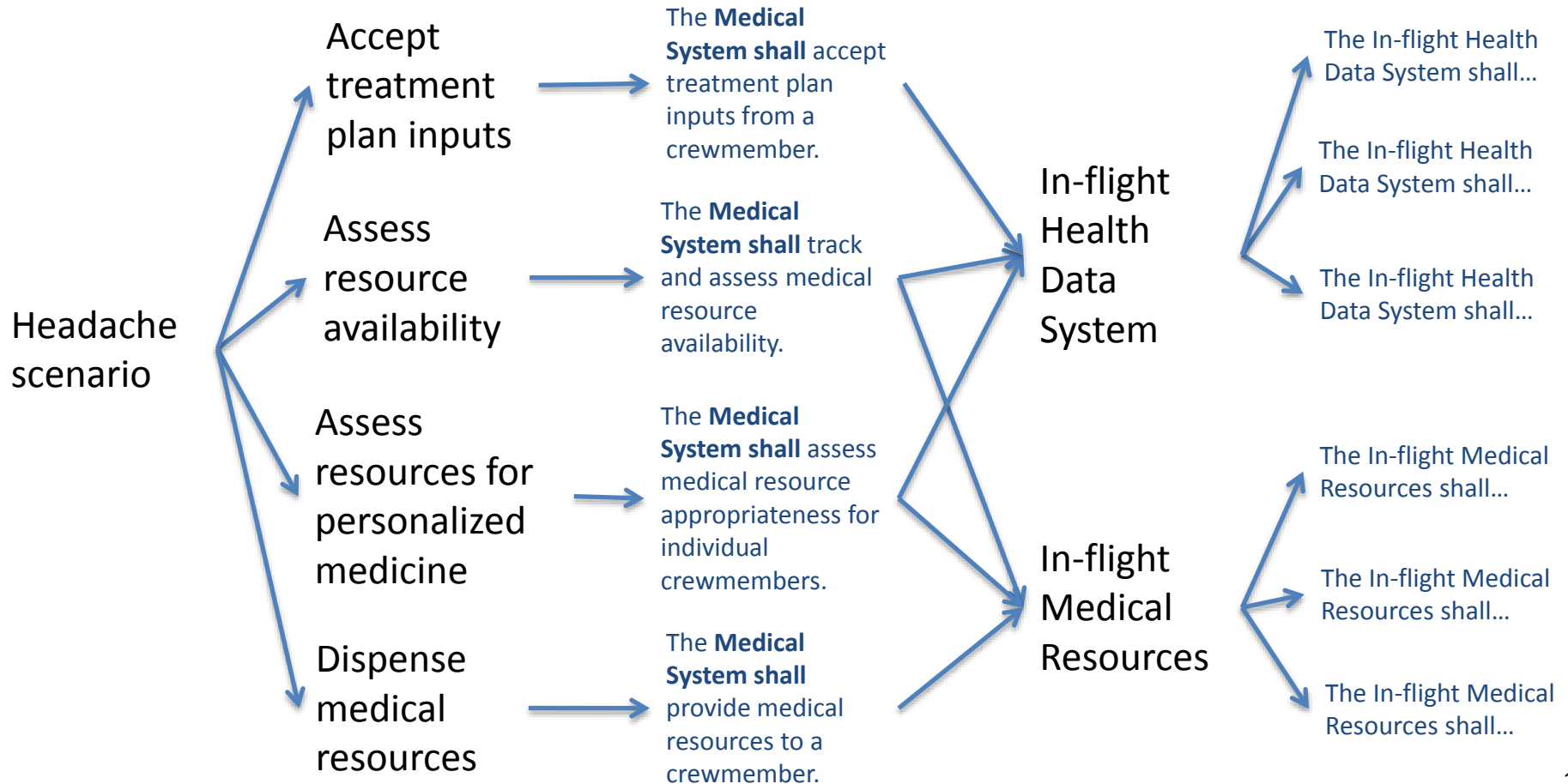
System functional needs

System requirements

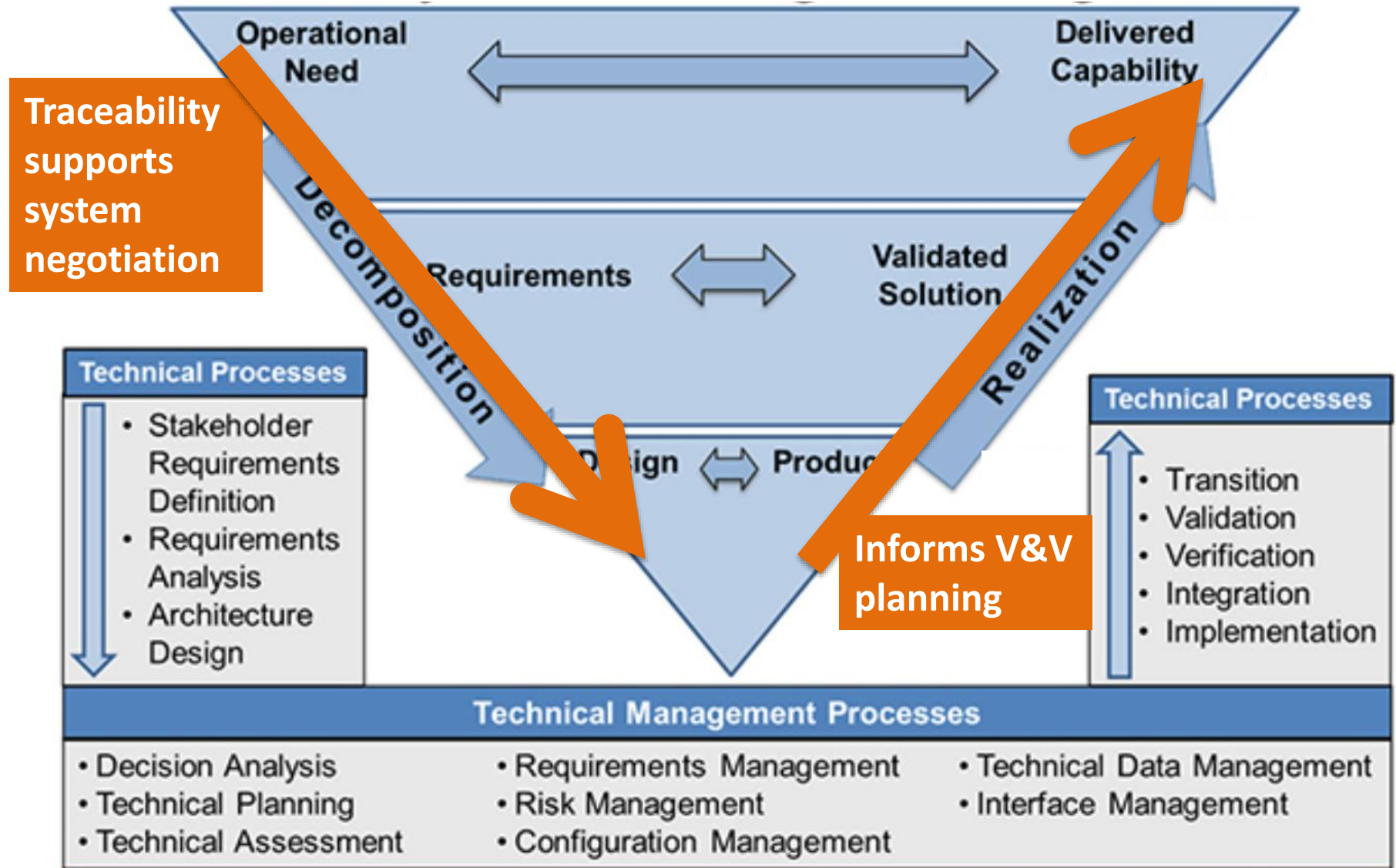
Allocations

Subsystem requirements

*All content is in draft form!*



# Systems Engineering Process “V” Example



# Summary

- “What” not “How” initially
  - ConOps → Functions → Requirements
- Structured approach
  - Envisioning and guiding the development of an exploration medical system is a big job
  - This approach gives an organized path
- Traceability
  - When negotiations are necessary regarding capabilities to include (hardware and/or software), we are able to trace to impacted requirements and system functions
  - Identify orphans – then why do we have this capability?
  - Identify parents with no implementation – function and capability are lacking  
→ **RESEARCH NEED**

# Conclusion

- Next steps
  - Top Down – continue:
    - Activities and interactions
    - Functional decomposition
    - System architecture
    - Traceability
  - Bottom Up – begin reconciling existing subsystem level content
  - Draft system functional requirements 2017
- Cross-disciplinary, cross-Center team has made huge strides in only a few months

# Thank you

